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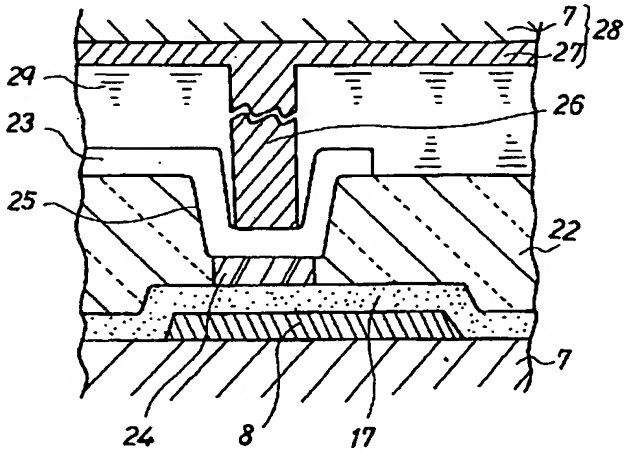
(54)【発明の名称】液晶表示装置

(57)【要約】
【課題】　安定した補助容量値を有し、かつ柱状スペーサの配置により基板間に均一なギャップが得られ、良好な表示が達成される液晶表示装置を提供する。
【解決手段】　本発明の液晶表示装置では、ＴＦＴアレイ基板の補助容量部において、アドレス配線８上にゲート絶縁膜１７を介して、データ配線９と同層に形成された補助容量用電極２４が配置されており、この補助容量用電極２４と下層のアドレス配線８とにより補助容量１６が形成されている。また、このような補助容量１６部に設けられたコンタクトホール２５内に、対向基板側の着色層の積層等により形成された柱状スペーサ２６が収容配置され、基板間のギャップが一定に保持されている。



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【特許請求の範囲】

【請求項１】　絶縁基板上に複数本のアドレス配線とデータ配線およびスイッチング素子がそれぞれ形成され、かつこのスイッチング素子の上層に絶縁層を介して設けられた画素電極と、該画素電極と電気的に接続された補助容量部とをそれぞれ有する第１の基板と、絶縁基板上に対向電極が形成された第２の基板と、前記第１の基板と第２の基板との間に挟持された液晶層とを備えた液晶表示装置において、

前記補助容量部を、前記データ配線と同層に形成された補助容量用電極と、該補助容量用電極と絶縁膜を介して対向配置された補助容量配線とにより形成するとともに、この補助容量用電極と前記画素電極とをコンタクトするコンタクトホール内に、前記第２の基板との間隙を保つための柱状スペーサを収容配置したことを特徴とする液晶表示装置。

【請求項２】　前記コンタクトホール部において、前記画素電極の面積が、該画素電極とコンタクトする前記補助容量用電極の面積よりも大きく形成されていることを特徴とする請求項１記載の液晶表示装置。

【請求項３】　前記補助容量部において、前記補助容量配線の幅が前記補助容量用電極の幅よりも大きく形成されていることを特徴とする請求項１または２記載の液晶表示装置。

【請求項４】　前記補助容量配線は前記アドレス配線を兼ねることを特徴とする請求項１乃至３のいずれか１項記載の液晶表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、液晶表示装置に係わり、特にアクティブマトリクス型の液晶表示装置に関する。

【０００２】

【従来の技術】アクティブマトリクス型液晶表示装置では、アレイ基板の画素の開口率を向上させ、液晶セルの光透過率を上げるために、以下に示す構造が採られている。

【０００３】すなわち、画素の開口率を大きく減じることなく十分な補助容量を設けるために、アドレス配線上に重なるように島状の電極をデータ配線と同一平面上に設け、この島状電極を絶縁膜に開孔したコンタクトホールを介して画素電極と電気的にコンタクトした構造のＴＦＴアレイ基板が使用されている。（特開平6-175156号公報記載）

【０００４】

【発明が解決しようとする課題】また、複数の色の着色層を積層することにより、対向基板側に柱状のスペーサを形成し、このスペーサにより基板間の間隙を一定に保つことが行なわれている。開口率を向上させるためには、このスペーサをアドレス配線上に配置することが好ましいが、スペーサの配置位置によっては、アレイ基板の表面形状の影響で基板間隔を均一に制御できないという問題があった。

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【０００５】本発明は、これらの問題を解決するためになされたもので、安定した補助容量値が得られる補助容量構造を有し、かつ柱状スペーサの配置により基板間に均一なギャップが得られ、良好な表示が達成される液晶表示装置を提供することを目的とする。

【０００６】

【課題を解決するための手段】本発明の液晶表示装置は、絶縁基板上に複数本のアドレス配線とデータ配線およびスイッチング素子がそれぞれ形成され、かつこのスイッチング素子の上層に絶縁層を介して設けられた画素電極と、該画素電極と電気的に接続された補助容量部とをそれぞれ有する第１の基板と、絶縁基板上に対向電極が形成された第２の基板と、前記第１の基板と第２の基板との間に挟持された液晶層とを備えた液晶表示装置において、前記補助容量部を、前記データ配線と同層に形成された補助容量用電極と、該補助容量用電極と絶縁膜を介して対向配置された補助容量配線とにより形成するとともに、この補助容量用電極と前記画素電極とをコンタクトするコンタクトホール内に、前記第２の基板との間隙を保つための柱状スペーサを収容配置したことを特徴とする。

【０００７】本発明において、第１の基板と第２の基板との間隙を保つための柱状スペーサは、通常異なる複数の色の層（着色層）の積層体として、対向基板上に突出形成される。そして、このような柱状スペーサにおいては、それぞれの着色層の表面粗さ、硬度、特定の不純物の含有量等に着目して、着色層の積層順を選択することにより、所望の特性を有する柱状スペーサを得ることができる。また、着色層を構成する樹脂固形分等の濃度がそれぞれ異なる場合には、各着色層の厚さ（高さ）や積層順を変えることにより、柱状スペーサ全体の高さを自由に変えることができ、さらに一定の積層順とすることにより、安定した高さを有する柱状スペーサを形成することができる。

【０００８】また本発明においては、補助容量配線がアドレス配線を兼ねることができる。本発明の液晶表示装置では、補助容量部が、データ配線と同層に形成された補助容量用電極と補助容量配線とから構成されているが、通常データ配線と同層は金属により形成され、加工性が良好でエッチング精度が高いので、補助容量用電極と補助容量配線とにより常に一定の補助容量値が得られ、良好な表示が実現される。

【０００９】また、このような補助容量用電極と画素電極とを電気的に接続するコンタクトホールは、底部が平坦で段差がなくかつ十分な面積を有しているので、このようなコンタクトホール内に、間隙材である柱状スペーサを安定して収容配置することができ、基板間に均一な

ギャップが保持される。したがって、表示むらがなくなり、歩留まりが向上する。

【００１０】さらに本発明では、フォトエッチングプロセスでの合わせ精度を考慮し、補助容量用電極と画素電極とをコンタクトするコンタクトホール部において、画素電極の面積を補助容量用電極の面積よりも大きく形成することが望ましい。このように画素電極の面積を補助容量用電極のそれより大きくした場合には、これらの電極形成における位置精度により、補助容量値が変動することがほとんどなく、良好な表示画質が得られるうえに、コンタクトホール内への柱状スペーサの配置が容易である。

【００１１】同様に、フォトエッチングプロセスでの合わせ精度を考慮して、補助容量用電極と下層の補助容量配線とから成る補助容量部においては、補助容量配線の幅を補助容量用電極の幅よりも大きく形成することが望ましい。このようにした場合には、補助容量配線および補助容量用電極の形成における位置精度により、補助容量値が変動することがなく、良好な表示画質が得られる。

【００１２】

【発明の実施の形態】以下、本発明の実施例を、図１乃至図４をそれぞれ参照して説明する。

【００１３】図１は、本発明の液晶表示装置の実施例に使用するＴＦＴアレイ基板の等価回路を示し、図２は、このＴＦＴアレイ基板の１画素あたりの概略平面図を示す。また、図３は、図２におけるＡ－Ａ線に沿ったＴＦＴの断面図を示し、図４は、同じく図２におけるＢ－Ｂ線に沿った補助容量部の断面図を示す。

【００１４】まず、実施例に使用するＴＦＴアレイ基板の概略を説明する。図１に示すように、ガラス基板のような透明な絶縁基板７上に、複数本のアドレス配線８と複数本のデータ配線９とが交差して形成され、その交差した各区画の画素ごとに、スイッチング素子としてＴＦＴ１０が形成されている。また、アドレス配線８と平行に補助容量配線１１が形成されている。そして、各画素において、ＴＦＴ１０のゲート電極１２はアドレス配線８に突出して形成され、電気的に接続されており、ドレイン電極１３はデータ配線９に突出して形成され、電気的に接続されている。さらに、ソース電極１４には、液晶容量１５と補助容量１６とがそれぞれ接続形成されている。

【００１５】次に、このようなＴＦＴアレイ基板の構造を説明する。

【００１６】実施例のＴＦＴアレイ基板では、図２および図３にそれぞれ示すように、絶縁基板７上に酸化シリコン等からなるアンダーコート膜（図示を省略。）を介して、Ａｌ、Ｍｏ、Ｗ、Ｔａ、Ｔｉ等の金属からなるアドレス配線８とゲート電極１２とが一体的に形成され、それらの上に、酸化シリコン等からなる表面が平坦化されたゲート絶縁膜１７が形成されている。また、ゲート電極１２の上方のゲート絶縁膜１７上に、チッ化ケイ素等からなる絶縁膜（図示を省略。）を介して、ａ－Ｓｉ（アモルファスシリコン）層１８とコンタクト層１９、およびチッ化ケイ素等からなるチャネル保護層２０とが順に設けられており、コンタクト層１９に接続してドレイン電極１３およびデータ配線９が形成されている。さらに、ドレイン電極１３の表面に酸化被膜１３ａが設けられ、それらの上に、表面が平坦化されかつ所定の位置にコンタクトホール２１が形成された絶縁膜（層間絶縁膜）２２が設けられている。またさらに、この層間絶縁膜２２上に、インジウム・ティン・オキサイド（ＩＴＯ）等の透明材料からなる画素電極２３が形成されており、さらにコンタクトホール２１部においてソース電極１４が形成され、このソース電極１４により、画素電極２３とコンタクト層１９とが電気的に接続されている。

【００１７】また、このようなＴＦＴアレイ基板の補助容量部では、図４に示すように、アドレス配線８上に、ゲート絶縁膜１７を介して、データ配線９と同層に形成された補助容量用電極２４が配置されており、この補助容量用電極２４と下層のアドレス配線８とにより、補助容量が形成されている。また、このような補助容量１６部の層間絶縁膜２２には、コンタクトホール２５が形成されており、このコンタクトホール２５部において、層間絶縁膜２２上に形成された画素電極２３と補助容量用電極２４とが電気的に接続されている。

【００１８】さらに、このようなコンタクトホール２５内に、柱状のスペーサ２６が収容配置され、その先端部がコンタクトホール２５部の画素電極２３に当接されている。すなわち、絶縁基板７上にカラーフィルタ２７が形成され、かつそれとともに着色層の積層により形成された柱状スペーサ２６を有する対向基板２８と、前記したＴＦＴアレイ基板とを対向配置し、基板間にＴＮ液晶のような液晶組成物２９を介在させた液晶表示装置において、ＴＦＴアレイ基板の補助容量部のコンタクトホール２５内に、柱状スペーサ２６の先端部が収容配置されている。また、このようなコンタクトホール２５部においては、画素電極２３の面積が下層の補助容量用電極２４の面積よりも大きく形成されており、さらに下層のアドレス配線８の幅が補助容量用電極２４の幅よりも大きく形成されている。

【００１９】このように構成される実施例の液晶表示装置においては、補助容量用電極２４がデータ配線９と同層で金属により形成されており、加工性が良好でエッチング精度が高いので、そのような補助容量用電極２４とアドレス配線８とから成る補助容量として、常に一定の値が得られ、良好な表示が実現される。

【００２０】また、このような補助容量用電極２４と画素電極２３とをコンタクトするコンタクトホール２５が、底部が平坦で段差がなくかつ十分な底面積を有して

いるので、このようなコンタクトホール２５内への柱状スペーサ２６の配置が容易で、安定して収容配置することができ、基板間に均一なギャップを得ることができる。したがって、表示むらがなくなり、歩留まりが向上する。

【００２１】さらに、コンタクトホール２５部において、画素電極２３の面積が補助容量用電極２４の面積より大きくなっているので、これらの電極形成における位置ずれにより補助容量の値が変動することが少なく、良好な表示画質が得られる。また、下層のアドレス配線８の幅が補助容量用電極２４の幅よりも大きくなっているので、これらの位置ずれにより補助容量値が変動することがほとんどなく、良好な表示画質が得られる。

【００２２】またさらに、画素電極２３が、アドレス配線８およびデータ配線９よりも上層の層間絶縁膜２２上に形成されているので、アドレス配線８とデータ配線９とがそれぞれ画素の遮光層として機能し、画素の開口率が向上する。また、ＴＦＴ部のコンタクトホール２１において、画素電極２３とＴＦＴのコンタクト層１９とを接続するようにソース電極１４が形成されており、このソース電極１４がＴＦＴへの遮光層となっているので、ＴＦＴの光リークによる画質低下を防ぐことができる。

【００２３】次に、本発明の具体的実施例について記載する。

【００２４】

【実施例】まず、以下に示すようにして、ＴＦＴアレイ基板を製造した。

【００２５】すなわち、絶縁基板７として 1.1mm厚のガラス基板（米国コーニング社製の＃7059）上に、基板の保護と基板からの汚染防止を目的として、酸化シリコンを、スパッタリング法またはプラズマＣＶＤ（ケミカルベーパーデポジション）法等により、約 300nmの厚さに堆積させて、アンダーコート膜を形成した後、このアンダーコート膜上に、スパッタリング法によりＡｌを約 200nmの膜厚に堆積させ、次いでアドレス配線８とゲート電極１２および補助容量配線１１のパターンの一部を、フォトリソグラフィーにより形成し、リン酸、硝酸、酢酸の混酸を用いてエッチングした。次いで、Ｍｏ・Ｔａをスパッタリング法により約 300nmの膜厚に堆積させ、アドレス配線８および補助容量配線１１のパターンの残り部分を、四フッ化炭素＋酸素の混合ガスのプラズマケミカルドライエッチング法により、エッジ部分にガラス基板７面に対して30度以下のテーパが形成されるようにエッチングした。このときのエッチング条件は、四フッ化炭素の流量 160sccm、酸素の流量 320sccm、エッチング圧力30Paであった。こうして、アドレス配線８と補助容量配線１１のパターンを完成させた。

【００２６】次に、酸化シリコンを、例えばテトラエチルオキシシランガスによるプラズマＣＶＤ法により、表面が平坦化するように堆積させた後、エッチング法あるいは研磨によりさらに平坦化して、ゲート絶縁膜１７を形成した。なお、ゲート絶縁膜１７の表面をこのように平坦化することにより、後工程でゲート絶縁膜１７上に形成されるデータ配線９などの段切れやカバレージの低下を防ぐことができる。　続いて、チッ化ケイ素からなる絶縁膜、ａ－Ｓｉ層１８、チッ化ケイ素からなるチャネル保護層２０の３層をＣＶＤ法により連続的に堆積させた後、上層のチャネル保護層２０をパターニングした。次いで、ａ－Ｓｉ層１８の両側のソース電極およびドレイン電極の接触部分に、ホスフィンガス（PH_3 ガス）を用いたイオン注入を行なって、低抵抗化されたコンタクト層１９を形成した後、ａ－Ｓｉ層１８をパターニングした。

【００２７】次に、スパッタリング法によりＡｌ膜を成膜しパターニングして、データ配線９とドレイン電極１３、およびデータ配線と同層の補助容量用電極２４をそれぞれ形成した。なお、ドレイン電極１３は、一方のコンタクト層１９上に形成した後、表面に陽極酸化処理により酸化被膜１３ａを形成し、後工程で形成される画素電極２３との層間絶縁性を向上させておいた。

【００２８】次いで、プラズマＣＶＤ法により、チッ化ケイ素からなる層間絶縁膜２２を形成した。なおこのとき、チッ化ケイ素を２層に分けて堆積させ、１層目のチッ化ケイ素層の堆積後、エッチバック法あるいは研磨処理により表面を平坦化させることが望ましい。このような処理を行なうことにより、最終的に形成される層間絶縁膜２２の表面が平坦化され、後工程でその上に形成される画素電極２３やソース電極１４の段切れやカバレージの低下を防ぐことができる。

【００２９】次に、こうして形成された表面が平坦化された層間絶縁膜２２上に、ＩＴＯ膜を成膜してからパターニングして画素電極２３を形成した。このとき、補助容量用電極２４の上層では、層間絶縁膜２２にコンタクトホール２５を形成し、このホール内にも連接して画素電極２３を形成した。なお、こうして形成されたコンタクト部において、底部の径を20～30μm 、画素電極２３の厚さを10～15μm とし、画素電極２３の接触面（下面）の径が下層の補助容量用電極２４の接触面（上面）の径より、片側で 1.5～ 4μm 大きくなるようにした。

【００３０】次いで、アドレス配線のパッド部の開口（画素電極２３とコンタクト層１９とをコンタクトするコンタクトホール２１）を、リアクティブ・イオン・エッチング（ＲＩＥ）およびＨＦ系エッチング液により形成した後、スパッタリング法によりＭｏ－Ａｌ－Ｍｏの３層を成膜してからパターニングしてソース電極１４を形成し、このソース電極２４により画素電極２３とＴＦＴのコンタクト層１９とを電気的に接続した。

【００３１】次に、こうして得られたＴＦＴアレイ基板の全面に、配向膜材料として AL-1051（日本合成ゴム株式会社製）を50nmの厚さに塗布し、ラビング処理を行な

って配向膜を形成した。

【００３２】次いで、対向基板側においては、1.1mm厚のガラス基板（コーニング社製の#7059）上に、アルカリ現像可能な光硬化型アクリル樹脂にカーボンブラック（黒色顔料）を分散させたフォトレジストをスピンコート法により塗布し、90℃で10分間乾燥した後、所定のパターン形状のフォトマスクを用いて300mj/cm² の光量で露光し、次いでpH11.5のアルカリ水溶液により現像し、200℃で 1時間ベークして、格子状パターンを有する膜厚 2.0μm の遮光層（ブラックマトリックス）を形成した。なお、遮光層としては、Ｃｒ、ＣｒＯ／Ｃｒ、ＣｒＯ／Ｃｒ／ＣｒＯなどの金属系の膜を用いることも可能である。

【００３３】次いで、このような遮光層が形成されたガラス基板上に、アルカリ現像可能な着色フォトレジストである CB-2000（富士ハントテクノロジー株式会社の商品名）をスピンコート法により塗布し、プリベークした後、所定の光量（100mj/cm²）で露光し、次いでpH11.5の現像液で現像し、 200℃で 1時間ベークして、膜厚2.2μm の青色着色層を形成した。このとき、青色着色層を、遮光層上の所定の位置にも形成し、直径20μm の青色スペーサを形成した。

【００３４】次に、こうして青色着色層が形成されたガラス基板上に、アルカリ現像可能な着色フォトレジストである CG-2000（富士ハントテクノロジー株式会社の商品名）をスピンコート法により塗布し、プリベークした後、所定の光量（100mj/cm²）で露光し、次いでpH11.5の現像液で現像し、 200℃で 1時間ベークして、膜厚1.8μm の緑色着色層を形成した。このとき緑色着色層を、先に形成した青色スペーサの上にも積層し、直径20μm の青色－緑色積層スペーサを形成した。

【００３５】さらに、こうして青色および緑色の着色層が形成されたガラス基板上に、アルカリ現像可能な市販の着色レジストである CR-2000（富士ハントテクノロジー株式会社の商品名）をスピンコート法により塗布し、プリベークした後、所定の光量（100mj/cm² ）で露光し、次いでpH11.5の現像液で現像し、 200℃で 1時間ベークして、膜厚 1.3μm の赤色着色層を形成した。このとき赤色着色層を、先に形成した青色－緑色積層スペーサの上にも積層し、青色－緑色－赤色の３色の着色層が積層された、直径20μm 、高さ 3～ 5μm の柱状スペーサを形成した。しかる後、青色、緑色、赤色の各着色層から成るカラーフィルタの上に、ＩＴＯからなる共通電極をスパッタリング法により形成し、さらにポリイミドからなる配向膜を形成した後、ラビングにより配向処理を施し、カラーフィルタおよび柱状スペーサを有する対向基板を得た。

【００３６】そして、得られた対向基板と前記したＴＦＴアレイ基板とを対向配置し、接着剤で貼り合わせた後、常法により注入口からＴＮ液晶組成物を注入し、次いで注入口を紫外線硬化樹脂で封止することにより、液晶表示装置を得た。

【００３７】こうして得られた液晶表示装置では、画素の開口率が高く高輝度であり、表示むらがなく良好な画質の表示が達成された。

【００３８】

【発明の効果】以上の説明から明らかなように、本発明の液晶表示装置においては、絶縁膜を挟んで対向した補助容量用電極とアドレス配線とにより、補助容量部が形成されており、補助容量用電極がデータ配線と同層で、金属により形成され加工性が良好でエッチング精度が高いので、常に一定の補助容量値が得られ、良好な表示画質が達成される。また、このような補助容量用電極と画素電極とをコンタクトする、段差がなく十分な面積を有するコンタクトホール内に、間隙材である柱状スペーサが収容配置されているので、基板間に均一なギャップが保持され、表示むらのない良好な表示が得られる。

【図面の簡単な説明】

【図１】本発明の液晶表示装置の実施例に使用するＴＦＴアレイ基板の等価回路図。

【図２】同実施例に使用するＴＦＴアレイ基板の１画素あたりの概略平面図。

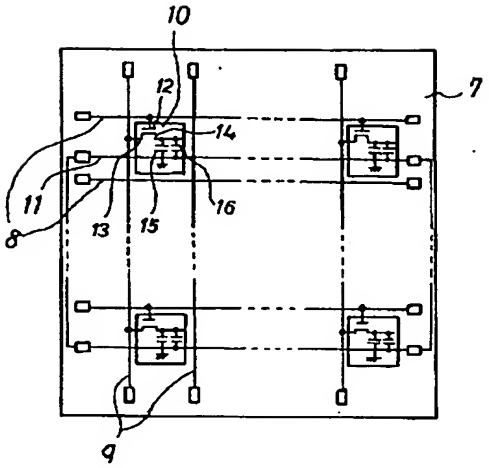
【図３】図２のＴＦＴアレイ基板におけるＡ－Ａ線に沿ったＴＦＴの断面図。

【図４】図２のＴＦＴアレイ基板におけるＢ－Ｂ線に沿った補助容量部の断面図。

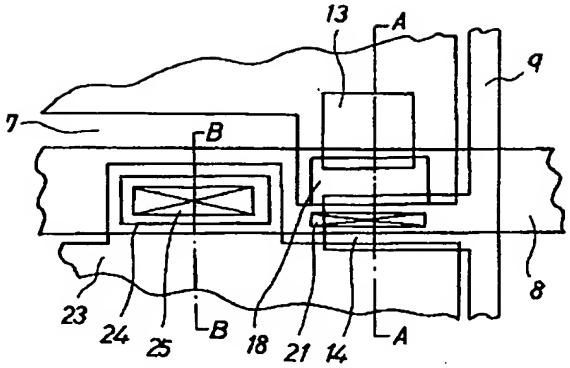
【符号の説明】

７……絶縁基板
８……アドレス配線
９……データ配線
１１……補助容量配線
１２……ゲート電極
１３……ドレイン電極
１４……ソース電極
１７……ゲート絶縁膜
１８……ａ－Ｓｉ層
１９……コンタクト層
２１、２５……コンタクトホール
２２……層間絶縁膜
２３……画素電極
２４……補助容量用電極
２６……柱状スペーサ

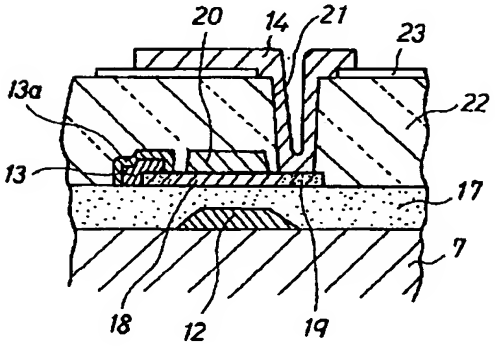
【図１】


10
12
14
7
11
13
15
16
8
9

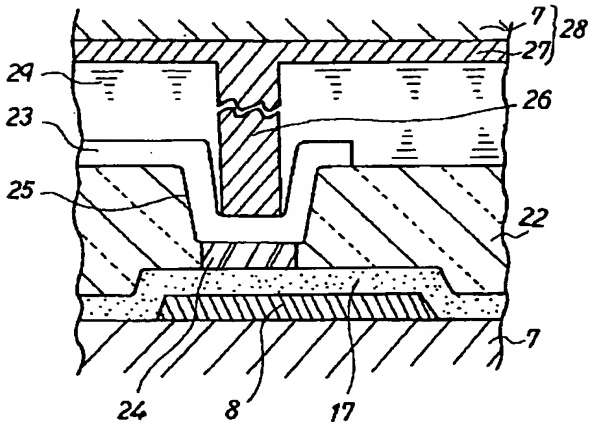
【図２】


13
A
9
7
B
8
23
24
25
B
18
21
14
A

【図３】


20
14
21
23
13a
22
13
17
7
18
12
19

【図４】


7
28
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29
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25
22
7
24
8
17

PATENT ABSTRACTS OF JAPAN

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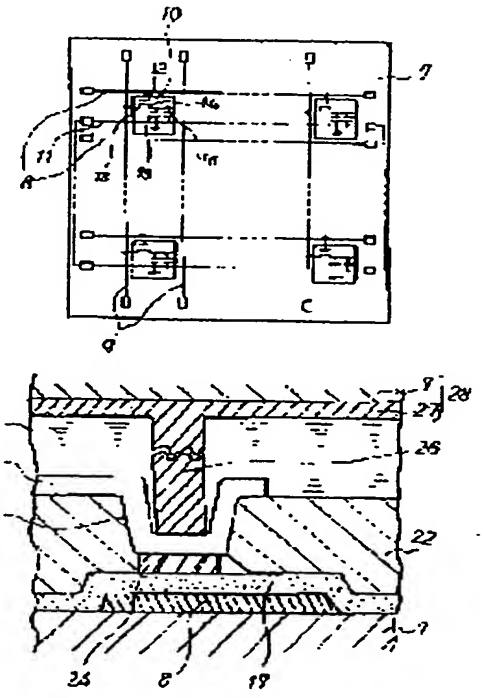
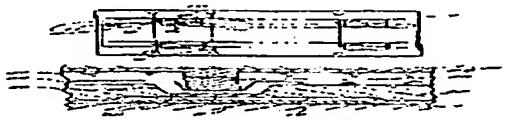
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a liquid crystal device permitting to have a stable auxiliary capacity value, obtain a uniform gap between substrates by arranging cylindrical spacers and achieve a good display.
SOLUTION: In an auxiliary capacity part of a TFT array substrate in this liquid crystal display device, an electrode 24 for an auxiliary capacity formed in a same layer as data wiring 9 is arranged via a gate





insulation film 17 on address wiring 8, and an auxiliary capacity 16 is formed from this electrode 24 for the auxiliary capacity and the lower layer of the address wiring 8. Further, in a contact hole 25 provided in such an auxiliary capacity part 16, a cylindrical spacer 26 formed from laminated layers of colored layers on the opposing substrate side is accommodated for an arrangement and keeps a fixed gap between the substrates.

LEGAL STATUS

[Date of request for examination]

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The pixel electrode which address wiring of two or more, data wiring, and a switching element were formed on the insulating substrate, respectively, and was prepared in the upper layer of the switching element of a parenthesis through the insulating layer, In the liquid crystal display equipped with the liquid crystal layer pinched between the 1st substrate which has the auxiliary part by volume electrically connected with this pixel electrode, respectively, the 2nd substrate with which the counterelectrode was formed on the insulating substrate, and said 1st substrate and 2nd substrate While forming said auxiliary part by volume with auxiliary capacity wiring by which opposite arrangement was carried out through said data wiring, the electrode for auxiliary capacity formed in this layer, this electrode for auxiliary capacity, and the insulator layer The liquid crystal display characterized by carrying out hold arrangement of the pillar-shaped spacer for maintaining a gap with said 2nd substrate in the contact hole which contacts this electrode for auxiliary capacity, and said pixel electrode.

[Claim 2] The liquid crystal display according to claim 1 characterized by forming the area of said pixel electrode in said contact hole section more greatly than the area of said electrode for auxiliary capacity in contact with this pixel electrode.
[Claim 3] The liquid crystal display according to claim 1 or 2 characterized by forming more greatly than the width of face of said electrode for auxiliary capacity the width of face of said auxiliary capacity wiring in said auxiliary part by volume.
[Claim 4] Said auxiliary capacity wiring is the liquid crystal display of three claim 1 characterized by serving as said address wiring thru/or given in any 1

term.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the liquid crystal display of a active-matrix mold with respect to a liquid crystal display.
[0002]
[Description of the Prior Art] In order to raise the numerical aperture of the pixel of an array substrate and to raise the light transmittance of a liquid crystal cell in an active matrix liquid crystal display, the structure shown below is taken.
[0003] That is, in order to prepare sufficient auxiliary capacity, without reducing the numerical aperture of a pixel greatly, an island-like electrode is prepared on the same flat surface as data wiring so that it may lap on address wiring, and the TFT array substrate of the structure which contacted the pixel electrode electrically through the contact hole which punctured this island-like electrode to the insulator layer is used. (JP,6-175156,A publication)
[0004]
[Problem(s) to be Solved by the Invention] Moreover, by carrying out the laminating of the coloring layer of two or more colors, a column-like spacer is formed in an opposite substrate side, and keeping the gap between substrates constant with this spacer is performed. Although it was desirable to have arranged this spacer on address wiring in order to raise a numerical aperture, there was a problem that substrate spacing was uncontrollable by the effect of the shape of surface type of an array substrate to homogeneity depending on the arrangement location of a spacer.
[0005] It was made in order to solve these problems, and it has the auxiliary capacity structure where the stable auxiliary capacity value is acquired, and a gap uniform between substrates is obtained by arrangement of a pillar-shaped spacer, and this invention aims at offering the liquid crystal display with which a good

display is attained.
[0006]
[Means for Solving the Problem] The pixel electrode with which address wiring of two or more, data wiring, and a switching element were formed on the insulating substrate, respectively, and the liquid crystal display of this invention was formed in the upper layer of the switching element of a parenthesis through the insulating layer, In the liquid crystal display equipped with the liquid crystal layer pinched between the 1st substrate which has the auxiliary part by volume electrically connected with this pixel electrode, respectively, the 2nd substrate with which the counterelectrode was formed on the insulating substrate, and said 1st substrate and 2nd substrate While forming said auxiliary part by volume with auxiliary capacity wiring by which opposite arrangement was carried out through said data wiring, the electrode for auxiliary capacity formed in this layer, this electrode for auxiliary capacity, and the insulator layer It is characterized by carrying out hold arrangement of the pillar-shaped spacer for maintaining a gap with said 2nd substrate in the contact hole which contacts this electrode for auxiliary capacity, and said pixel electrode.
[0007] In this invention, the pillar-shaped spacer for maintaining the gap of the 1st substrate and the 2nd substrate is projected and formed on an opposite substrate as a layered product of the layer (coloring layer) of two or more usually different colors. And in such a pillar-shaped spacer, the pillar-shaped spacer which has a desired property can be obtained by choosing the order of a laminating of a coloring layer paying attention to the surface roughness of each coloring layer, a degree of hardness, the content of a specific impurity, etc. Moreover, when concentration, such as resin solid content which constitutes a coloring layer, differs, respectively, by changing the thickness (height) and the order of a laminating of each coloring layer, the height of the whole pillar-shaped spacer can be changed freely, and the pillar-shaped spacer which has the stable height can be formed by considering as the still more fixed order of a laminating.
[0008] Moreover, auxiliary capacity wiring can serve as address wiring in this invention. In the liquid crystal display of this invention, although the auxiliary part by volume consists of data wiring, an electrode for auxiliary capacity formed in this layer, and auxiliary capacity wiring, since data wiring and this layer are formed with a metal, its workability is good and etching precision is high, fixed auxiliary capacity value is always acquired with the electrode for auxiliary capacity, and auxiliary capacity wiring, and a good display is usually realized.
[0009] Moreover, since the contact hole which connects electrically such an electrode for auxiliary capacity and a pixel electrode has a flat pars basilaris ossis occipitalis, and there is no level difference and it has sufficient area, in such a

contact hole, it is stabilized, hold arrangement of the pillar-shaped spacer which is gap material can be carried out, and a uniform gap is held between substrates. Therefore, display unevenness is lost and the yield improves.

[0010] In the contact hole section which contacts the electrode for auxiliary capacity, and a pixel electrode in consideration of the doubling precision in a photo etching process in this invention, it is still more desirable to form the area of a pixel electrode more greatly than the area of the electrode for auxiliary capacity. Thus, when area of a pixel electrode is made larger than that of the electrode for auxiliary capacity, with the location precision in these electrode formation, auxiliary capacity value is hardly changed, and good display image quality is acquired, and also arrangement of the pillar-shaped spacer into a contact hole is easy.

[0011] Similarly, in the auxiliary part by volume which consists of the electrode for auxiliary capacity, and lower layer auxiliary capacity wiring in consideration of the doubling precision in a photo etching process, it is desirable to form the width of face of auxiliary capacity wiring more greatly than the width of face of the electrode for auxiliary capacity. When it does in this way, with the location precision in formation of auxiliary capacity wiring and the electrode for auxiliary capacity, auxiliary capacity value is not changed and good display image quality is acquired.

[0012]

[Embodiment of the Invention] Hereafter, the example of this invention is explained respectively with reference to drawing 1 thru/or drawing 4 .

[0013] Drawing 1 shows the equal circuit of the TFT array substrate used for the example of the liquid crystal display of this invention, and drawing 2 shows the outline top view per pixel of this TFT array substrate. Moreover, drawing 3 shows the sectional view of TFT which met the A-A line in drawing 2 , and drawing 4 shows the sectional view of an auxiliary part by volume which similarly met the B-B line in drawing 2 .

[0014] First, the outline of the TFT array substrate used for an example is explained. As shown in drawing 1 , on a transparent insulating substrate 7 like a glass substrate, the address wiring 8 of two or more and the data wiring 9 of two or more cross, and are formed, and TFT10 is formed as a switching element for every [the] pixel of each crossing partition. Moreover, the auxiliary capacity wiring 11 is formed in parallel with the address wiring 8. And in each pixel, the gate electrode 12 of TFT10 is projected and formed in the address wiring 8, and is electrically connected to it, and the drain electrode 13 is projected and formed in the data wiring 9, and is electrically connected to it. Furthermore, connection

formation of the liquid crystal capacity 15 and the auxiliary capacity 16 is carried out at the source electrode 14, respectively.

[0015] Next, the structure of such a TFT array substrate is explained.

[0016] In the TFT array substrate of an example, as shown in drawing 2 and drawing 3 , respectively, the address wiring 8 and the gate electrode 12 which consist of metals, such as aluminum, Mo, W, Ta, and Ti, through the under coat film (illustration is omitted.) which consists of silicon oxide etc. on an insulating substrate 7 are formed in one, and the gate dielectric film 17 with which flattening of the front face which consists of silicon oxide etc. on them was carried out is formed. Moreover, the channel protective layer 20 which consists of the a-Si (amorphous silicon) layer 18, a contact layer 19, CHITSU-ized silicon, etc. is formed in order on the upper gate dielectric film 17 of the gate electrode 12 through the insulator layer (illustration is omitted.) which consists of CHITSU-ized silicon etc., it connects with the contact layer 19 and the drain electrode 13 and the data wiring 9 are formed. Furthermore, the insulator layer (interlayer insulation film) 22 by which oxide skin 13a was prepared in the front face of the drain electrode 13, and flattening of the front face was carried out on them, and the contact hole 21 was formed in the position is formed. Furthermore, the pixel electrode 23 which consists of transparent materials, such as indium Tin oxide (ITO), is formed on this interlayer insulation film 22, the source electrode 14 is further formed in the contact hole 21 section, and the pixel electrode 23 and the contact layer 19 are electrically connected by this source electrode 14.

[0017] Moreover, in such an auxiliary part by volume of a TFT array substrate, as shown in drawing 4 , on the address wiring 8, the data wiring 9 and the electrode 24 for auxiliary capacity formed in this layer are arranged through gate dielectric film 17, and auxiliary capacity is formed with this electrode 24 for auxiliary capacity, and the lower layer address wiring 8. Moreover, the contact hole 25 is formed in the interlayer insulation film 22 of such the auxiliary capacity 16 section, and the pixel electrode 23 and the electrode 24 for auxiliary capacity which were formed on the interlayer insulation film 22 are electrically connected to it in this contact hole 25 section.

[0018] Furthermore, in such a contact hole 25, hold arrangement of the column-like spacer 26 is carried out, and the point is contacted by the pixel electrode 23 of the contact hole 25 section. That is, opposite arrangement of the opposite substrate 28 which has the pillar-shaped spacer 26 which the color filter 27 was formed on the insulating substrate 7, and was formed of the laminating of a coloring layer with it, and the above mentioned TFT array substrate is carried out, and hold arrangement of the point of the pillar-shaped spacer 26 is carried

out in the liquid crystal display which made a liquid crystal constituent 29 like TN liquid crystal intervene between substrates into the contact hole 25 of the auxiliary part by volume of a TFT array substrate. Moreover, in such the contact hole 25 section, the area of the pixel electrode 23 is formed more greatly than the area of the lower layer electrode 24 for auxiliary capacity, and the width of face of the address wiring 8 of further a lower layer is formed more greatly than the width of face of the electrode 24 for auxiliary capacity.

[0019] Thus, in the liquid crystal display of the example constituted, the electrode 24 for auxiliary capacity is formed with the metal in the data wiring 9 and this layer, since workability is good and etching precision is high, a fixed value is always acquired as an auxiliary capacity which consists of such an electrode 24 for auxiliary capacity, and the address wiring 8, and a good display is realized.

[0020] Moreover, since a pars basilaris ossis occipitalis is flat, there is no level difference and the contact hole 25 which contacts such an electrode 24 for auxiliary capacity and the pixel electrode 23 has sufficient area of base, it is easy, and it can be stabilized, and arrangement of the pillar-shaped spacer 26 into such a contact hole 25 can carry out hold arrangement, and can obtain a uniform gap between substrates. Therefore, display unevenness is lost and the yield improves.

[0021] Furthermore, in the contact hole 25 section, since the area of the pixel electrode 23 is larger than the area of the electrode 24 for auxiliary capacity, it is rare to change the value of auxiliary capacity by the location gap in these electrode formation, and good display image quality is acquired. Moreover, since the width of face of the lower layer address wiring 8 is larger than the width of face of the electrode 24 for auxiliary capacity, auxiliary capacity value is hardly changed by these location gaps, and good display image quality is acquired.

[0022] Furthermore, since the pixel electrode 23 is formed on the upper interlayer insulation film 22 rather than the address wiring 8 and the data wiring 9, the address wiring 8 and the data wiring 9 function as a protection-from-light layer which is a pixel, respectively, and the numerical aperture of a pixel improves. Moreover, in the contact hole 21 of the TFT section, since the source electrode 14 is formed so that the pixel electrode 23 and the contact layer 19 of TFT may be connected, and this source electrode 14 serves as a protection-from-light layer to TFT, the image quality fall by optical leak of TFT can be prevented.

[0023] Next, the concrete example of this invention is indicated.

[0024]

[Example] First, as it was shown below, the TFT array substrate was manufactured.

[0025] That is, it is an insulating substrate 7. It aims at protection of a substrate and the pollution control from a substrate on the glass substrate (#7059 by U.S.

Corning, Inc.) of 1.1mm thickness. silicon oxide -- the sputtering method or plasma CVD (chemical vapor deposition) -- by law etc. Abbreviation After making the thickness of 300nm deposit and forming the under coat film, On this under coat film, it is abbreviation about aluminum by the sputtering method. It is made to deposit on 200nm thickness. Subsequently, some patterns of the address wiring 8 and the gate electrode 12 **** auxiliary capacity wiring 11 were formed with photolithography, and it was etched using the mixed acid of a phosphoric acid, a nitric acid, and an acetic acid. Subsequently, it is abbreviation by the sputtering method about Mo-Ta. It was made to deposit on 300nm thickness, and the remaining part of the pattern of the address wiring 8 **** auxiliary capacity wiring 11 was etched so that the taper of 30 or less degrees might be formed in an edge part to the 7th page of a glass substrate by the plasma chemical dry etching method of the mixed gas of carbon tetrafluoride + oxygen. The etching conditions at this time are the flow rate of carbon tetrafluoride. 160sccm, flow rate of oxygen It was 30Pa in 320sccm and etching pressure. In this way, the pattern of the address wiring 8 and the auxiliary capacity wiring 11 was completed.

[0026] Next, after making silicon oxide deposit so that a front face may carry out flattening by the plasma-CVD method for example, by tetraethyl oxy-silane gas, flattening of it was further carried out by the etching method or polish, and gate dielectric film 17 was formed. In addition, the fall of stage pieces, such as the data wiring 9 formed on gate dielectric film 17 at a back process, or a coverage can be prevented by carrying out flattening of the front face of gate dielectric film 17 in this way. Then, after making three layers, the insulator layer and the a-Si layer 18 which consist of CHITSU-ized silicon, and the channel protective layer 20 which consists of CHITSU-ized silicon, deposit continuously with a CVD method, patterning of the upper channel protective layer 20 was carried out. Subsequently, after performing the ion implantation which used phosphine gas (PH3 gas) for the contact parts of the source electrode of the both sides of the a-Si layer 18, and a drain electrode and forming the contact layer 19 formed into low resistance, patterning of the a-Si layer 18 was carried out.

[0027] Next, aluminum film was formed by the sputtering method, patterning was carried out, and the data wiring 9, the drain electrode 13, and data wiring and the electrode 24 for auxiliary capacity of this layer were formed, respectively. In addition, after forming the drain electrode 13 on one contact layer 19, it raised layer insulation nature with the pixel electrode 23 which forms oxide skin 13a in a front face by anodizing, and is formed at a back process.

[0028] Subsequently, the interlayer insulation film 22 which consists of CHITSU-ized silicon was formed by the plasma-CVD method. In addition, at this time, CHITSU-ized silicon is made to divide and deposit on two-layer, and it is

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desirable after deposition of a CHITSU-ized silicon layer of the 1st layer to carry out flattening of the front face by the etchback method or polish processing. By performing such processing, flattening of the front face of the interlayer insulation film 22 finally formed is carried out, and it can prevent the fall of the stage piece of the pixel electrode 23 or the source electrode 14 formed on it at a back process, or a coverage.

[0029] Next, on the interlayer insulation film 22 with which flattening of the front face formed in this way was carried out, after forming the ITO film, patterning was carried out and the pixel electrode 23 was formed. At this time, in the upper layer of the electrode 24 for auxiliary capacity, the contact hole 25 was formed in the interlayer insulation film 22, it connected [interlayer insulation film] also in this hole, and the pixel electrode 23 was formed. In addition, it sets in the contact section formed in this way, and is 20-30 micrometers about the path of a pars basilaris ossis occipitalis. It is 10-15 micrometers about the thickness of the pixel electrode 23. It carries out and the path of the contact surface (inferior surface of tongue) of the pixel electrode 23 is at one side from the path of the contact surface (top face) of the lower layer electrode 24 for auxiliary capacity. 1.5 to 4 micrometer It was made to become large.

[0030] Subsequently, after forming opening (contact hole 21 which contacts the pixel electrode 23 and the contact layer 19) of the pad section of address wiring with reactive ion etching (RIE) and HF system etching reagent, after forming three layers of Mo-aluminum-Mo by the sputtering method, patterning was carried out, the source electrode 14 was formed, and the pixel electrode 23 and the contact layer 19 of TFT were electrically connected with this source electrode 24.

[0031] Next, it is an orientation film ingredient to the whole surface of the TFT array substrate obtained in this way. AL-1051 (Japan Synthetic Rubber Co., Ltd. make) was applied to the thickness of 50nm, rubbing processing was performed, and the orientation film was formed.

[0032] Also to an opposite substrate side, subsequently, on the glass substrate (#7059 by Corning, Inc.) of 1.1mm thickness The photoresist which made the photo-curing mold acrylic resin in which alkali development is possible distribute carbon black (black pigment) is applied with a spin coat method. the photo mask of the predetermined pattern configuration after drying for 10 minutes at 90 degrees C -- using -- 300 mj/cm2 it exposes with the quantity of light and, subsequently negatives are developed with the alkali water solution of pH11.5 -- 200 degree C BEKU for 1 hour Thickness which has a grid-like pattern 2.0 micrometers The protection-from-light layer (black matrix) was formed. In addition, as a protection-from-light layer, it is also possible to use the film of

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metal systems, such as Cr, CrO/Cr, and CrO/Cr/CrO.
[0033] subsequently, it is the coloring photoresist in which alkali development is possible on the glass substrate with which such a protection-from-light layer was formed after applying CB-2000 (trade name of Fuji hunt technology incorporated company) with a spin coat method and prebaking it, it exposes with the predetermined quantity of light (100 mj/cm2), and, subsequently negatives are developed with the developer of pH11.5 -- 200 degree C 1 hour -- BEKU -- 2.2 micrometers of thickness The blue coloring layer was formed. At this time, a blue coloring layer is formed also in the position on a protection-from-light layer, and it is the diameter of 20 micrometers. Blue SUPE 1 SA was formed.
[0034] next, it is the coloring photoresist in which alkali development is possible on the glass substrate with which the blue coloring layer was formed in this way after applying CG-2000 (trade name of Fuji hunt technology incorporated company) with a spin coat method and prebaking it, it exposes with the predetermined quantity of light (100 mj/cm2), and, subsequently negatives are developed with the developer of pH11.5 -- 200 degree C 1 hour -- BEKU -- 1.8 micrometers of thickness The green stain layer was formed. At this time, the laminating of the green stain layer is carried out also on blue SUPE 1 SA formed previously, and it is the diameter of 20 micrometers. Blue-green laminating SUPE 1 SA was formed.
[0035] Furthermore, on the glass substrate with which the blue and green coloring layer was formed in this way It is the coloring resist of marketing in which alkali development is possible. CR-2000 (trade name of Fuji hunt technology incorporated company) is applied with a spin coat method. after prebaking, it exposes with the predetermined quantity of light (100 mj/cm2), and, subsequently negatives are developed with the developer of pH11.5 -- 200 degree C 1 hour -- BEKU -- thickness 1.3 micrometers The red coloring layer was formed. Diameter of 20 micrometers to which the laminating of the red coloring layer was carried out also on blue-green laminating SUPE 1 SA formed previously at this time, and the laminating of the coloring layer of three colors of blue-green-red was carried out Height Three to 5 micrometer Pillar-shaped SUPE 1 SA was formed. After forming the common electrode which consists of ITO by the sputtering method on the color filter which consists of each coloring layer of blue, green, and red and forming the orientation film which consists of polyimide further after an appropriate time, orientation processing was performed by rubbing and the opposite substrate which has a color filter and a pillar-shaped spacer was obtained.
[0036] And after carrying out opposite arrangement and sticking the obtained opposite substrate and the above mentioned TFT array substrate with adhesives,

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TN liquid crystal constituent was poured in from the inlet with the conventional method, and the liquid crystal display was obtained by subsequently closing an inlet with ultraviolet-rays hardening resin.

[0037] In this way, in the obtained liquid crystal display, the numerical aperture of a pixel was high brightness highly, there is no display unevenness and the display of good image quality was attained.

[0038]

[Effect of the Invention] Since the auxiliary part by volume is formed in the liquid crystal display of this invention with the electrode for auxiliary capacity and address wiring which countered on both sides of the insulator layer, and the electrodes for auxiliary capacity are data wiring and this layer, it is formed with a metal, workability is good and etching precision is high so that clearly from the above explanation, fixed auxiliary capacity value is always acquired and good display image quality is attained. Moreover, in the contact hole which contacts such an electrode for auxiliary capacity, and a pixel electrode and which there is no level difference and has sufficient area, since hold arrangement of the pillar-shaped spacer which is gap material is carried out, a gap uniform between substrates is held and the good display without display unevenness is obtained.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention] Especially this invention relates to the liquid crystal display of a active-matrix mold with respect to a liquid crystal display.

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PRIOR ART

[Description of the Prior Art] In order to raise the numerical aperture of the pixel of an array substrate and to raise the light transmittance of a liquid crystal cell in an active matrix liquid crystal display, the structure shown below is taken.
[0003] That is, in order to prepare sufficient auxiliary capacity, without reducing the numerical aperture of a pixel greatly, an island-like electrode is prepared on the same flat surface as data wiring so that it may lap on address wiring, and the TFT array substrate of the structure which contacted the pixel electrode electrically through the contact hole which punctured this island-like electrode to the insulator layer is used. (JP,6-175156,A publication)

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] Since the auxiliary part by volume is formed in the liquid crystal display of this invention with the electrode for auxiliary capacity and address wiring which countered on both sides of the insulator layer, and the electrodes for auxiliary capacity are data wiring and this layer, it is formed with a metal, workability is good and etching precision is high so that clearly from the above explanation, fixed auxiliary capacity value is always acquired and good display image quality is attained. Moreover, in the contact hole which contacts such an electrode for auxiliary capacity, and a pixel electrode and which there is no level difference and has sufficient area, since hold arrangement of the pillar-shaped spacer which is gap material is carried out, a gap uniform between substrates is held and the good display without display unevenness is obtained.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Moreover, by carrying out the laminating of the coloring layer of two or more colors, a column-like spacer is formed in an opposite substrate side, and keeping the gap between substrates constant with this spacer is performed. Although it was desirable to have arranged this spacer on address wiring in order to raise a numerical aperture, there was a problem that substrate spacing was uncontrollable by the effect of the shape of surface type of an array substrate to homogeneity depending on the arrangement location of a spacer.
[0005] It was made in order to solve these problems, and it has the auxiliary capacity structure where the stable auxiliary capacity value is acquired, and a gap uniform between substrates is obtained by arrangement of a pillar-shaped spacer, and this invention aims at offering the liquid crystal display with which a good display is attained.

[Translation done.]

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MEANS

[Means for Solving the Problem] The pixel electrode with which address wiring of two or more, data wiring, and a switching element were formed on the insulating substrate, respectively, and the liquid crystal display of this invention was formed in the upper layer of the switching element of a parenthesis through the insulating layer, In the liquid crystal display equipped with the liquid crystal layer pinched between the 1st substrate which has the auxiliary part by volume electrically connected with this pixel electrode, respectively, the 2nd substrate with which the counterelectrode was formed on the insulating substrate, and said 1st substrate and 2nd substrate While forming said auxiliary part by volume with auxiliary capacity wiring by which opposite arrangement was carried out through said data wiring, the electrode for auxiliary capacity formed in this layer, this electrode for auxiliary capacity, and the insulator layer It is characterized by carrying out hold arrangement of the pillar-shaped spacer for maintaining a gap with said 2nd substrate in the contact hole which contacts this electrode for auxiliary capacity, and said pixel electrode.
[0007] In this invention, the pillar-shaped spacer for maintaining the gap of the 1st substrate and the 2nd substrate is projected and formed on an opposite substrate as a layered product of the layer (coloring layer) of two or more usually different colors. And in such a pillar-shaped spacer, the pillar-shaped spacer which has a desired property can be obtained by choosing the order of a laminating of a coloring layer paying attention to the surface roughness of each coloring layer, a degree of hardness, the content of a specific impurity, etc. Moreover, when concentration, such as resin solid content which constitutes a coloring layer, differs, respectively, by changing the thickness (height) and the order of a laminating of each coloring layer, the height of the whole pillar-shaped spacer can be changed freely, and the pillar-shaped spacer which has the stable height can be formed by considering as the still more fixed order of a laminating.

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[0008] Moreover, auxiliary capacity wiring can serve as address wiring in this invention. In the liquid crystal display of this invention, although the auxiliary part by volume consists of data wiring, an electrode for auxiliary capacity formed in this layer, and auxiliary capacity wiring, since data wiring and this layer are formed with a metal, its workability is good and etching precision is high, fixed auxiliary capacity value is always acquired with the electrode for auxiliary capacity, and auxiliary capacity wiring, and a good display is usually realized.
[0009] Moreover, since the contact hole which connects electrically such an electrode for auxiliary capacity and a pixel electrode has a flat pars basilaris ossis occipitalis, and there is no level difference and it has sufficient area, in such a contact hole, it is stabilized, hold arrangement of the pillar-shaped spacer which is gap material can be carried out, and a uniform gap is held between substrates. Therefore, display unevenness is lost and the yield improves.
[0010] In the contact hole section which contacts the electrode for auxiliary capacity, and a pixel electrode in consideration of the doubling precision in a photo etching process in this invention, it is still more desirable to form the area of a pixel electrode more greatly than the area of the electrode for auxiliary capacity. Thus, when area of a pixel electrode is made larger than that of the electrode for auxiliary capacity, with the location precision in these electrode formation, auxiliary capacity value is hardly changed, and good display image quality is acquired, and also arrangement of the pillar-shaped spacer into a contact hole is easy.
[0011] Similarly, in the auxiliary part by volume which consists of the electrode for auxiliary capacity, and lower layer auxiliary capacity wiring in consideration of the doubling precision in a photo etching process, it is desirable to form the width of face of auxiliary capacity wiring more greatly than the width of face of the electrode for auxiliary capacity. When it does in this way, with the location precision in formation of auxiliary capacity wiring and the electrode for auxiliary capacity, auxiliary capacity value is not changed and good display image quality is acquired.
[0012]
[Embodiment of the Invention] Hereafter, the example of this invention is explained respectively with reference to drawing 1 thru/or drawing 4 .
[0013] Drawing 1 shows the equal circuit of the TFT array substrate used for the example of the liquid crystal display of this invention, and drawing 2 shows the outline top view per pixel of this TFT array substrate. Moreover, drawing 3 shows the sectional view of TFT which met the A-A line in drawing 2 , and drawing 4 shows the sectional view of an auxiliary part by volume which

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similarly met the B-B line in drawing 2 .

[0014] First, the outline of the TFT array substrate used for an example is explained. As shown in drawing 1 , on a transparent insulating substrate 7 like a glass substrate, the address wiring 8 of two or more and the data wiring 9 of two or more cross, and are formed, and TFT10 is formed as a switching element for every [the] pixel of each crossing partition. Moreover, the auxiliary capacity wiring 11 is formed in parallel with the address wiring 8. And in each pixel, the gate electrode 12 of TFT10 is projected and formed in the address wiring 8, and is electrically connected to it, and the drain electrode 13 is projected and formed in the data wiring 9, and is electrically connected to it. Furthermore, connection formation of the liquid crystal capacity 15 and the auxiliary capacity 16 is carried out at the source electrode 14, respectively.

[0015] Next, the structure of such a TFT array substrate is explained.

[0016] In the TFT array substrate of an example, as shown in drawing 2 and drawing 3 , respectively, the address wiring 8 and the gate electrode 12 which consist of metals, such as aluminum, Mo, W, Ta, and Ti, through the under coat film (illustration is omitted.) which consists of silicon oxide etc. on an insulating substrate 7 are formed in one, and the gate dielectric film 17 with which flattening of the front face which consists of silicon oxide etc. on them was carried out is formed. Moreover, the channel protective layer 20 which consists of the a-Si (amorphous silicon) layer 18, a contact layer 19, CHITSU-ized silicon, etc. is formed in order on the upper gate dielectric film 17 of the gate electrode 12 through the insulator layer (illustration is omitted.) which consists of CHITSU-ized silicon etc., it connects with the contact layer 19 and the drain electrode 13 and the data wiring 9 are formed. Furthermore, the insulator layer (interlayer insulation film) 22 by which oxide skin 13a was prepared in the front face of the drain electrode 13, and flattening of the front face was carried out on them, and the contact hole 21 was formed in the position is formed. Furthermore, the pixel electrode 23 which consists of transparent materials, such as indium Tin oxide (ITO), is formed on this interlayer insulation film 22, the source electrode 14 is further formed in the contact hole 21 section, and the pixel electrode 23 and the contact layer 19 are electrically connected by this source electrode 14.

[0017] Moreover, in such an auxiliary part by volume of a TFT array substrate, as shown in drawing 4 , on the address wiring 8, the data wiring 9 and the electrode 24 for auxiliary capacity formed in this layer are arranged through gate dielectric film 17, and auxiliary capacity is formed with this electrode 24 for auxiliary capacity, and the lower layer address wiring 8. Moreover, the contact hole 25 is formed in the interlayer insulation film 22 of such the auxiliary capacity 16

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section, and the pixel electrode 23 and the electrode 24 for auxiliary capacity which were formed on the interlayer insulation film 22 are electrically connected to it in this contact hole 25 section.

[0018] Furthermore, in such a contact hole 25, hold arrangement of the column-like spacer 26 is carried out, and the point is contacted by the pixel electrode 23 of the contact hole 25 section. That is, opposite arrangement of the opposite substrate 28 which has the pillar-shaped spacer 26 which the color filter 27 was formed on the insulating substrate 7, and was formed of the laminating of a coloring layer with it, and the above mentioned TFT array substrate is carried out, and hold arrangement of the point of the pillar-shaped spacer 26 is carried out in the liquid crystal display which made a liquid crystal constituent 29 like TN liquid crystal intervene between substrates into the contact hole 25 of the auxiliary part by volume of a TFT array substrate. Moreover, in such the contact hole 25 section, the area of the pixel electrode 23 is formed more greatly than the area of the lower layer electrode 24 for auxiliary capacity, and the width of face of the address wiring 8 of further a lower layer is formed more greatly than the width of face of the electrode 24 for auxiliary capacity.

[0019] Thus, in the liquid crystal display of the example constituted, the electrode 24 for auxiliary capacity is formed with the metal in the data wiring 9 and this layer, since workability is good and etching precision is high, a fixed value is always acquired as an auxiliary capacity which consists of such an electrode 24 for auxiliary capacity, and the address wiring 8, and a good display is realized.

[0020] Moreover, since a pars basilaris ossis occipitalis is flat, there is no level difference and the contact hole 25 which contacts such an electrode 24 for auxiliary capacity and the pixel electrode 23 has sufficient area of base, it is easy, and it can be stabilized, and arrangement of the pillar-shaped spacer 26 into such a contact hole 25 can carry out hold arrangement, and can obtain a uniform gap between substrates. Therefore, display unevenness is lost and the yield improves.

[0021] Furthermore, in the contact hole 25 section, since the area of the pixel electrode 23 is larger than the area of the electrode 24 for auxiliary capacity, it is rare to change the value of auxiliary capacity by the location gap in these electrode formation, and good display image quality is acquired. Moreover, since the width of face of the lower layer address wiring 8 is larger than the width of face of the electrode 24 for auxiliary capacity, auxiliary capacity value is hardly changed by these location gaps, and good display image quality is acquired.

[0022] Furthermore, since the pixel electrode 23 is formed on the upper interlayer insulation film 22 rather than the address wiring 8 and the data wiring 9, the address wiring 8 and the data wiring 9 function as a protection-from-light layer which is a pixel, respectively, and the numerical aperture of a pixel improves.

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Moreover, in the contact hole 21 of the TFT section, since the source electrode 14 is formed so that the pixel electrode 23 and the contact layer 19 of TFT may be connected, and this source electrode 14 serves as a protection-from-light layer to TFT, the image quality fall by optical leak of TFT can be prevented.
[0023] Next, the concrete example of this invention is indicated.

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EXAMPLE

[Example] First, as it was shown below, the TFT array substrate was manufactured.
[0025] That is, it is an insulating substrate 7. It aims at protection of a substrate and the pollution control from a substrate on the glass substrate (#7059 by U.S. Corning, Inc.) of 1.1mm thickness, silicon oxide -- the sputtering method or plasma CVD (chemical vapor deposition) -- by law etc. Abbreviation After making the thickness of 300nm deposit and forming the under coat film, On this under coat film, it is abbreviation about aluminum by the sputtering method. It is made to deposit on 200nm thickness. Subsequently, some patterns of the address wiring 8 and the gate electrode 12 **** auxiliary capacity wiring 11 were formed with photolithography, and it was etched using the mixed acid of a phosphoric acid, a nitric acid, and an acetic acid. Subsequently, it is abbreviation by the sputtering method about Mo-Ta. It was made to deposit on 300nm thickness, and the remaining part of the pattern of the address wiring 8 **** auxiliary capacity wiring 11 was etched so that the taper of 30 or less degrees might be formed in an edge part to the 7th page of a glass substrate by the plasma chemical dry etching method of the mixed gas of carbon tetrafluoride + oxygen. The etching conditions at this time are the flow rate of carbon tetrafluoride. 160sccm, flow rate of oxygen It was 30Pa in 320sccm and etching pressure. In this way, the pattern of the address wiring 8 and the auxiliary capacity wiring 11 was completed.
[0026] Next, after making silicon oxide deposit so that a front face may carry out flattening by the plasma-CVD method for example, by tetraethyl oxy-silane gas, flattening of it was further carried out by the etching method or polish, and gate dielectric film 17 was formed. In addition, the fall of stage pieces, such as the data wiring 9 formed on gate dielectric film 17 at a back process, or a coverage can be prevented by carrying out flattening of the front face of gate dielectric film 17 in this way. Then, after making three layers, the insulator layer and the a-Si

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layer 18 which consist of CHITSU-ized silicon, and the channel protective layer 20 which consists of CHITSU-ized silicon, deposit continuously with a CVD method, patterning of the upper channel protective layer 20 was carried out. Subsequently, after performing the ion implantation which used phosphine gas (PH3 gas) for the contact parts of the source electrode of the both sides of the a-Si layer 18, and a drain electrode and forming the contact layer 19 formed into low resistance, patterning of the a-Si layer 18 was carried out.

[0027] Next, aluminum film was formed by the sputtering method, patterning was carried out, and the data wiring 9, the drain electrode 13, and data wiring and the electrode 24 for auxiliary capacity of this layer were formed, respectively. In addition, after forming the drain electrode 13 on one contact layer 19, it raised layer insulation nature with the pixel electrode 23 which forms oxide skin 13a in a front face by anodizing, and is formed at a back process.

[0028] Subsequently, the interlayer insulation film 22 which consists of CHITSU-ized silicon was formed by the plasma-CVD method. In addition, at this time, CHITSU-ized silicon is made to divide and deposit on two-layer, and it is desirable after deposition of a CHITSU-ized silicon layer of the 1st layer to carry out flattening of the front face by the etchback method or polish processing. By performing such processing, flattening of the front face of the interlayer insulation film 22 finally formed is carried out, and it can prevent the fall of the stage piece of the pixel electrode 23 or the source electrode 14 formed on it at a back process, or a coverage.

[0029] Next, on the interlayer insulation film 22 with which flattening of the front face formed in this way was carried out, after forming the ITO film, patterning was carried out and the pixel electrode 23 was formed. At this time, in the upper layer of the electrode 24 for auxiliary capacity, the contact hole 25 was formed in the interlayer insulation film 22, it connected [interlayer insulation film] also in this hole, and the pixel electrode 23 was formed. In addition, it sets in the contact section formed in this way, and is 20-30 micrometers about the path of a pars basilaris ossis occipitalis. It is 10-15 micrometers about the thickness of the pixel electrode 23. It carries out and the path of the contact surface (inferior surface of tongue) of the pixel electrode 23 is at one side from the path of the contact surface (top face) of the lower layer electrode 24 for auxiliary capacity. 1.5 to 4 micrometer It was made to become large.

[0030] Subsequently, after forming opening (contact hole 21 which contacts the pixel electrode 23 and the contact layer 19) of the pad section of address wiring with reactive ion etching (RIE) and HF system etching reagent, after forming three layers of Mo-aluminum-Mo by the sputtering method, patterning was carried out, the source electrode 14 was formed, and the pixel electrode 23 and

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the contact layer 19 of TFT were electrically connected with this source electrode 24.

[0031] Next, it is an orientation film ingredient to the whole surface of the TFT array substrate obtained in this way. AL-1051 (Japan Synthetic Rubber Co., Ltd. make) was applied to the thickness of 50nm, rubbing processing was performed, and the orientation film was formed.

[0032] Subsequently, it is a spin coat method about the photoresist which made the photo-curing mold acrylic resin in which alkali development is possible distribute carbon black (black pigment) also to an opposite substrate side on the glass substrate (#7059 by Corning, Inc.) of 1.1mm thickness. the photo mask of the predetermined pattern configuration after applying and drying for 10 minutes at 90 degrees C -- using -- 300 mj/cm2 it exposes with the quantity of light and, subsequently negatives are developed with the alkali water solution of pH11.5 -- 200 degree C Thickness which for 1 hour and has a grid-like pattern 2.0 micrometers The protection-from-light layer (black matrix) was formed. In addition, as a protection-from-light layer, it is also possible to use the film of metal systems, such as Cr, CrO/Cr, and CrO/Cr/CrO.

[0033] subsequently, it is the coloring photoresist in which alkali development is possible on the glass substrate with which such a protection-from-light layer was formed after applying CB-2000 (trade name of Fuji hunt technology incorporated company) with a spin coat method and prebaking it, it exposes with the predetermined quantity of light (100 mj/cm2), and, subsequently negatives are developed with the developer of pH11.5 -- 200 degree C 1 hour -- BEKU -- 2.2 micrometers of thickness The blue coloring layer was formed. At this time, a blue coloring layer is formed also in the position on a protection-from-light layer, and it is the diameter of 20 micrometers. Blue SUPE 1 SA was formed.

[0034] next, it is the coloring photoresist in which alkali development is possible on the glass substrate with which the blue coloring layer was formed in this way after applying CG-2000 (trade name of Fuji hunt technology incorporated company) with a spin coat method and prebaking it, it exposes with the predetermined quantity of light (100 mj/cm2), and, subsequently negatives are developed with the developer of pH11.5 -- 200 degree C 1 hour -- BEKU -- 1.8 micrometers of thickness The green stain layer was formed. At this time, the laminating of the green stain layer is carried out also on blue SUPE 1 SA formed previously, and it is the diameter of 20 micrometers. Blue-green laminating SUPE 1 SA was formed.

[0035] Furthermore, it is the coloring resist of marketing in which alkali development is possible on the glass substrate with which the blue and green coloring layer was formed in this way. It is a spin coat method about CR-2000

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(trade name of Fuji hunt technology incorporated company). after applying and prebaking, it exposes with the predetermined quantity of light (100 mj/cm2), and, subsequently negatives are developed with the developer of pH11.5 -- 200 degree C 1 hour -- BEKU -- thickness 1.3 micrometers The red coloring layer was formed. Diameter of 20 micrometers to which the laminating of the red coloring layer was carried out also on blue-green laminating SUPE 1 SA formed previously at this time, and the laminating of the coloring layer of three colors of blue-green-red was carried out Height Three to 5 micrometer Pillar-shaped SUPE 1 SA was formed. After forming the common electrode which consists of ITO by the sputtering method on the color filter which consists of each coloring layer of blue, green, and red and forming the orientation film which consists of polyimide further after an appropriate time, orientation processing was performed by rubbing and the opposite substrate which has a color filter and a pillar-shaped spacer was obtained.

[0036] And after carrying out opposite arrangement and sticking the obtained opposite substrate and the above mentioned TFT array substrate with adhesives, TN liquid crystal constituent was poured in from the inlet with the conventional method, and the liquid crystal display was obtained by subsequently closing an inlet with ultraviolet-rays hardening resin.

[0037] In this way, in the obtained liquid crystal display, the numerical aperture of a pixel was high brightness highly, there is no display unevenness and the display of good image quality was attained.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The representative circuit schematic of the TFT array substrate used for the example of the liquid crystal display of this invention.
[Drawing 2] The outline top view per pixel of the TFT array substrate used for this example.
[Drawing 3] The sectional view of TFT which met the A-A line in the TFT array substrate of drawing 2 .
[Drawing 4] The sectional view of an auxiliary part by volume which met the B-B line in the TFT array substrate of drawing 2 .
[Description of Notations]
7 ..... Insulating substrate
8 ..... Address wiring
9 ..... Data wiring
11 ..... Auxiliary capacity wiring
12 ..... Gate electrode
13 ..... Drain electrode
14 ..... Source electrode
17 ..... Gate dielectric film
18 ..... a-Si layer
19 ..... Contact layer
21 25 ..... Contact hole
22 ..... Interlayer insulation film
23 ..... Pixel electrode
24 ..... Electrode for auxiliary capacity
26 ..... Pillar-shaped spacer

[Translation done.]

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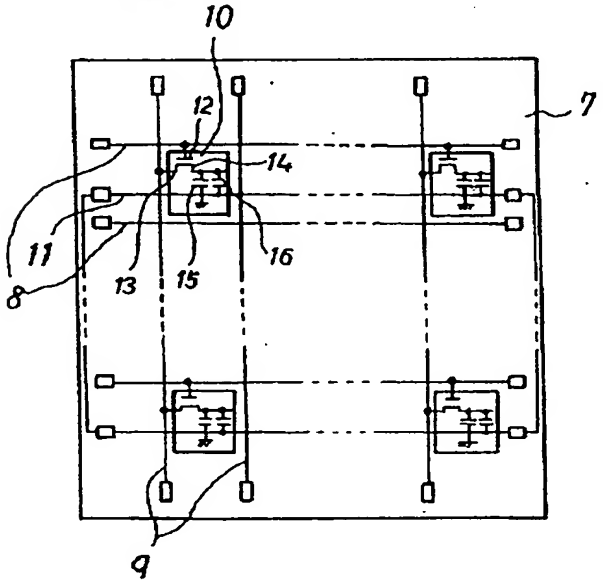
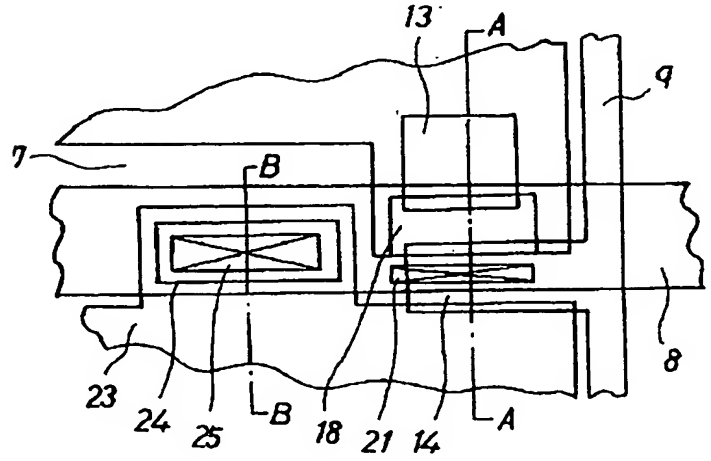
DRAWINGS

[Drawing 1]



[Drawing 2]



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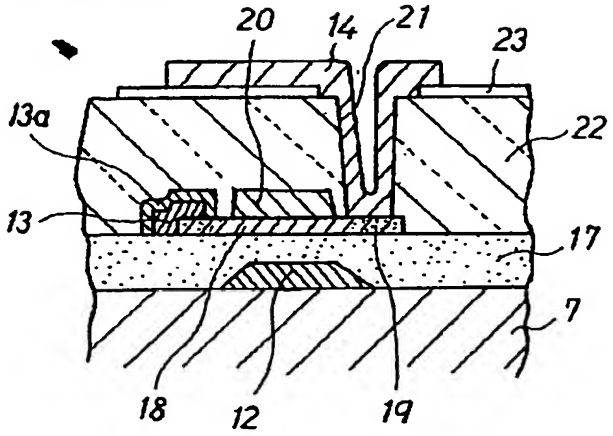
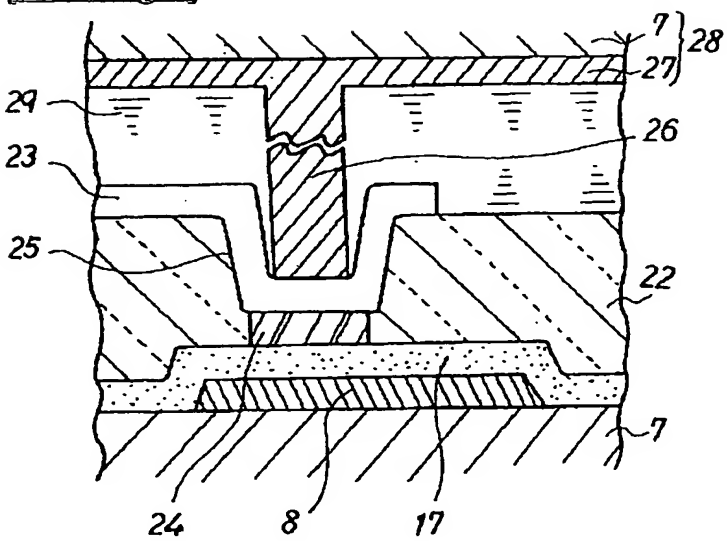
[Drawing 3]



[Drawing 4]



[Translation done.]